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Review of the Office of Research and Development's Proposed Budget for Fiscal Year 1988

(U.S.) Environmental Protection Agency
Washington, DC

Prepared for

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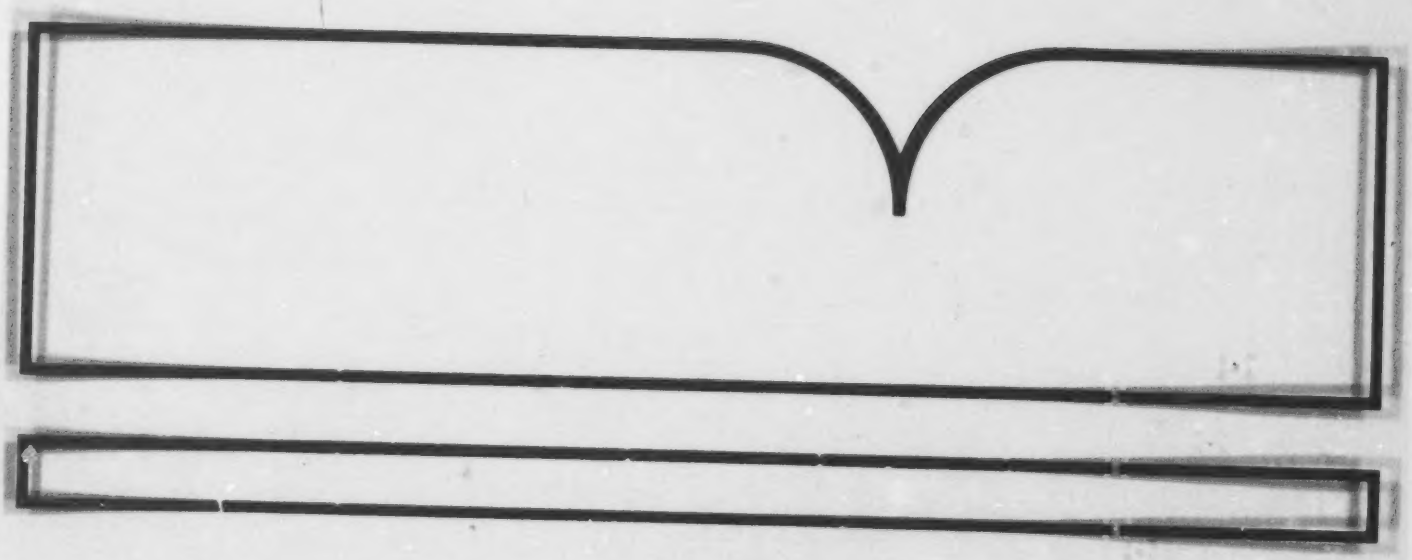

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D C 20460

March 6, 1987

SAB-EC-87-024

Honorable Lee M. Thomas
Administrator
U. S. Environmental Protection
Agency
401 M Street, S. W.
Washington, D. C. 20460

OFFICE OF
THE ADMINISTRATOR

Dear Mr. Thomas:

The Science Advisory Board's (SAB) Research and Development Budget Subcommittee has completed its second annual review of the President's proposed budget for the Office of Research and Development and is pleased to transmit copies to you and Congressional committees that authorize and appropriate funds for this office.

The President's proposed research budget for Fiscal Year (FY) 1988 for the Office of Research and Development (ORD) is $353.5 million and 1,844 workyears, an increase of $8.3 million and a reduction of 22 workyears from the current fiscal year. The proposed budget provides a relatively stable basis for research planning, while allowing for modest overall growth.

The scope of the Subcommittee's review addresses three major issues: 1) trends in the research budget; 2) continuing core needs of EPA's research program; and 3) comments on specific research programs in eight major areas--air, radiation, water quality, drinking water, pesticides/toxic substances, hazardous wastes/Superfund, energy/acid rain and interdisciplinary research.

The proposed budget should facilitate ORD's capability to provide technical support for ongoing regulatory programs and allow for some modest additional initiatives for issues that are of rising priority. In general, the Subcommittee believes that those programs earmarked for funding increases can effectively utilize these resources. There are some components of the research program that are currently underfunded but, given the current budgetary climate, the Subcommittee recommends additional funding only if Congress appropriates new resources.

The Subcommittee and the SAB Executive Committee believe that the enclosed report adds to the range of viewpoints that the Administration and the Congress should consider in reaching budgetary decisions, and that scientists and engineers have a responsibility to present their thoughts and evaluations of the scientific needs of one of the nation's most important institutions.

We appreciate the opportunity to review the proposed research budget and request that the Agency respond to the advice and recommendations provided in this report.

Sincerely,

John Neuhold, Chairman
Research and Development Budget Subcommittee
Science Advisory Board

Norton Nelson, Chairman
Executive Committee
Science Advisory Board

cc: A. James Barnes
Vaun Newill
Terry F. Yosie

SAB-EC-87-024

REVIEW OF THE OFFICE OF RESEARCH AND DEVELOPMENT'S PROPOSED BUDGET FOR FISCAL YEAR 1988

Research and Development Budget Subcommittee

Science Advisory Board

U. S. Environmental Protection Agency

March, 1987

U. S. ENVIRONMENTAL PROTECTION AGENCY

NOTICE

This report has been written as a part of the activities of the Science Advisory Board, a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board is structured to provide a balanced expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency, and hence the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor of other agencies in the Executive Branch of the Federal government, nor does mention of trade names or commercial products constitute endorsement of recommendation for use.

U. S. ENVIRONMENTAL PROTECTION AGENCY

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I. Executive Summary

The President's proposed budget for Fiscal Year (FY) 1988 for the Office of Research and Development (ORD) is $353.5 million and 1,844 workyears, an increase of $8.3 million and a reduction of 22 workyears from the current fiscal year. The proposed budget provides a relatively stable basis for research planning, while allowing for modest overall growth.

This is the second consecutive annual review by the Science Advisory Board of the President's research budget recommendations. To conduct this review, the Board created a Research and Development Budget Subcommittee. The scope of the Subcommittee's review addresses three major issues. These include: 1) trends in the research budget; 2) continuing core needs of EPA's research program; and 3) comments on specific research programs in eight major areas--air, radiation, water quality, drinking water, pesticides/toxic substances, hazardous wastes/Superfund, energy/acid rain and interdisciplinary research.

The proposed budget supports ORD's capability to provide technical support for ongoing regulatory programs and will enable it to develop initiatives for some selected issues that are of rising priority. In general, the Subcommittee believes that those programs earmarked for funding increases can effectively utilize these resources. There are some components of the research program that are currently underfunded but, given the current budgetary climate, the Subcommittee recommends additional funding only if Congress authorizes and appropriates new resources.

In last year's report, the Subcommittee pointed out that, over a number of years, a serious underfunding of the in-house program had occurred and recommended a reversal of this trend. A modest increase in these resources is available during the current fiscal year, and a further small increase (of $2 million for a total of $104 million) is proposed for FY '88. The Subcommittee

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reiterates its recommendation of last year that even greater support of the in-house program is needed.

Providing adequate support for the in-house research program, combined with resolving several salient needs of ORD personnel, can greatly contribute to the productivity of the Office of Research and Development. A strong in-house capability can also enable ORD to more effectively manage its extramural budget.

EPA's ability to achieve its goal of building risk-based decision making will rest largely on its ability to maintain and enhance the technical skills of its personnel through training and other forms of professional development. In order to achieve this objective, the Subcommittee recommends that EPA undertake two initiatives:

o Develop a strategy to better define EPA's key scientific staffing needs. Such a strategy should address the magnitude of the current skills-mix problem, training and other needs of existing staff, identification of new scientific skills needed and their relationship to new hiring decisions, analyses of resources needed for key risk assessment activities and their relationship to workload models, and recommendation of specific steps that build competence in risk assessment.

o Analyze the budgetary implications of such a strategy with the goal of making specific recommendations to the Office of Management and Budget and the Congress to provide adequate levels of support.

At present, there are a number of issues of growing public concern which, through thoughtful and prompt EPA response, can be effectively managed. Examples include stratospheric ozone modification and climate change, biotechnology, and assessing risks to ecosystems. What is needed is for EPA to develop a better system of "eyes and ears" that can alert it to issues beyond today's immediate regulatory and statutory priorities.

The Subcommittee recommends two mechanisms to aid in developing an improved capability to define emerging issues. The first is to revive a previous EPA initiative entitled the Environmental Outlook. The purpose of this document was to provide information on environmental trends and future problems, with a particular emphasis on the relationship between socio-economic changes and their influence on the environment.

A second mechanism available to EPA is the investigator-initiated exploratory grants program. This program should be reoriented to permit more input from laboratory and program office directors and to improve their ability to utilize the results of investigator-initiated research. A central theme of the grants program should be to develop data and methodologies for risk assessment or risk reduction. If this occurs, a greater constituency for the program will evolve within EPA and should not lessen the ability of extramural scientists to continue their practice of submitting investigator-initiated research proposals, nor compromise their ability to perform innovative research.

II. Introduction and Scope of the Review

To provide the scientific data needed to identify and assess public health and environmental problems, and to support the promulgation and enforcement of regulations and standards under its authorizing statutes, the Environmental Protection Agency maintains a number of research programs. Congress has long recognized the need for improved scientific data and the important linkage between the Agency's research and regulatory activities, and has recently augmented the research program by authorizing that research be conducted under the Superfund Amendments and Reauthorization Act.

Managing a research program in a regulatory Agency is an extremely difficult task. The very nature of the regulatory process--with its short deadlines, and oftentimes rapidly changing priorities--confronts EPA's research

programs with a set of challenges that most research organizations, such as the National Institutes of Health and National Science Foundation, do not encounter in either frequency or degree. At the same time, research carried out by EPA needs to achieve the same standards of quality expected of other research organizations by the scientific community. These and other challenges to EPA's research have existed since the Agency's inception and will persist.

The Science Advisory Board, since its creation, has observed and actively reviewed the scientific quality and direction of EPA's research programs. Beginning last fiscal year, the Board initiated two steps that are consistent with its independent research review role. These steps included: agreeing with ORD's recommendation to evaluate at least six individual research programs per fiscal year; and reviewing the President's proposed research budget for the coming fiscal year. The Board has continued this activity to the present time.

The Science Advisory Board's ongoing reviews of research programs and budgets address several interrelated issues. These include:

- o Evaluation of EPA's research needs and current research carried out or sponsored by the Agency. Particular emphasis is placed on the future direction of research needs and efforts.
- o The integration of research data and methodologies across programs.
- o The skills of EPA scientific personnel.

The Board's review of the proposed research budget for FY '88 was carried out by its Research and Development Budget Subcommittee. The Subcommittee met in executive session on January 6-7, 1987 in Washington, D. C. to receive detailed background briefings from the staff of both the Office of Research and Development and the Office of the Comptroller, and to begin preliminary

drafting of its report. On January 15, the Subcommittee's Chairman, Dr. John Neuhold, briefed the Executive Committee of its preliminary findings. The Executive Committee approved the report on March 4, 1986.

The Subcommittee's review addresses three major issues. These include: 1) trends in the research budget; 2) continuing core needs of EPA's research program; and 3) comments on specific research programs in eight major areas--air, radiation, water quality, drinking water, pesticides/toxic substances, hazardous wastes/Superfund, energy/acid rain and interdisciplinary research.

The Subcommittee also reflected on Administration and Congressional responses to its budgetary report of last year and found two encouraging developments. One is the gradual stability of the research program that has evolved over the past several years, in both dollars and staff, in the face of continuing pressure for budgetary reductions across the Federal government. The second is the slowly growing amount of resources made available to EPA's in-house research program. While the Subcommittee continues to believe that the in-house program is underfunded, senior EPA managers recognize the importance of the issue.

Because of time and other limitations, the Subcommittee did not attempt to conduct a budgetary review of every research program. Instead, it commented upon programs that either account for a large fraction of the budget, address significant scientific issues in support of EPA regulatory programs or receive insufficient priority given the magnitude of the scientific or public policy issues that are at stake. A summary of the program categories in the research budget for FY '88 is presented in Appendix I.

III. Trends in the Research Budget

1. Resource Levels

To be productive, any research program must experience continuity in research direction and management and have access to a stable level of resources. This need for stability stems from a number of intersecting factors including: the lead time required to acquire and maintain skilled technical personnel and equipment; planning and executing the research design; data analysis and interpretation; and preparation and publication of technical reports, including peer review.

EPA's FY '88 research budget proposal of $353.5 million, an increase of $8.3 million over the current FY '87 estimate, provides a stable basis of funding, while allowing for modest overall growth. This represents a welcome trend that has been evolving since FY '84. It should support ORD's capability to provide technical support for ongoing regulatory programs and will enable it to allow for some modest additional initiatives for issues that are of rising priority. In general, the Subcommittee believes that those programs earmarked for funding increases can efficiently absorb these resources. There are some components of the research program that are currently underfunded but, given the current budgetary climate, the Subcommittee recommends additional funding only if Congress authorizes and appropriates new resources.

Personnel work years, or FTEs (Full Time Equivalents), experience a reduction of 21.6 from the FY '87 level of 1,865.8. Table I presents ORD budgetary and FTE data between FY '80 and the FY '88 proposal.

TABLE I

OFFICE OF RESEARCH AND DEVELOPMENT BUDGETARY AND PERSONNEL RESOURCES

FY '80 THROUGH FY '87

	$ in Millions*	FTE
FY '80 Actuals	$ 336.47	2,344.3
FY '81 Actuals	299.04	2,167.7
FY '82 Actuals	244.69	1,982.0
FY '83 Actuals	215.12	1,853.2
FY '84 Actuals	234.84	1,782.9
FY '85 Actuals	286.95	1,804.6
FY '86 Actuals	320.02	1,821.6
FY '87 Estimate	345.20	1,865.8
FY '88 Proposal	353.51	1,844.2

* (Includes Salaries and Expenses and Extramural Research and Development)

2. Intramural and Extramural Resources

ORD funds are appropriated into two general categories, salaries and expenses (S&E) and research and development (R&D). S&E funds support staff salaries and the major in-house research programs conducted by ORD laboratories and field stations. R&D funds are generally applied toward research conducted by extramural scientists and engineers and are directed at developing scientific methodologies and data in various program areas, in addition to EPA sponsored scientific workshops and peer reviews.

In last year's report, the Subcommittee pointed out that, over a number of years, a serious underfunding of the in-house program had occurred and recommended a reversal of this trend. A modest increase in these resources is available during the current fiscal year, and a further small increase (of

$2 million for a total of $104 million) is proposed for FY '88. The Subcommittee reiterates its recommendation of last year that even greater support of the in-house program is needed.

IV. Some Continuing Core Needs of EPA's Research Program

The public health and environmental issues that confront EPA and its research programs continue to grow in both number and complexity. In addition, many of the scientific issues with which it contends are also relatively new to the scientific community's research agenda. Examples of these issues include investigating the risks of health effects other than cancer, assessing the public health hazards associated with exposures to chemical mixtures at hazardous waste sites, and examining the potential environmental effects of genetically engineered organisms.

One of the central challenges of managing EPA's research and development program is the need to keep pace with and respond expeditiously to the sometimes rapidly changing regulatory agenda. To successfully meet this challenge, ORD must articulate a core research agenda that conceptually defines, integrates and implements EPA's key information needs, while introducing new scientific approaches. It must also maintain a core of scientific talent with sufficient flexibility and breadth to exibit knowledge of both existing and emerging scientific problems, and with sufficient depth to synthesize and interpret scientific data in a manner that will withstand independent scrutiny by the scientific community and regulated parties. It also needs expertise to meet the increasing requests for technical support from EPA regional offices and the states.

The ability to maintain a core agenda supported by appropriate and skilled scientific staff is directly affected by the level of budgetary support

provided for the program, but it is an issue that also transcends the budget to encompass or reflect such issues as: the development of effective working relationships with extramural scientists, the private sector and the Congress; the freedom to publish research results and enter into productive working relationships with colleagues outside the immediate research program; avenues for skill enhancement; and career opportunities. This report focuses only on some areas the Subcommittee believes are more directly affected by the availability of budgetary support. These include: maintaining skilled personnel and instituting an improved capability to identify emerging environmental problems.

1. Personnel

Providing adequate support for the in-house research program, combined with resolving several salient needs of ORD personnel, can greatly contribute to the productivity of the Office of Research and Development.

What are some of ORD's major personnel needs? One need stems from the age structure of ORD staff. During a FY '86 study of the functions influencing the use of S&E resources, some characteristics were identified that are displayed in Table II.

TABLE II[1]

Some Characteristics of EPA Personnel in ORD and Non-ORD Programs

ORD Personnel	Non-ORD Personnel
58% over age 40	36% over age 40
46% with 16+ years of work experience in the Federal government	24% with 16+ years of work experience in the Federal government
35% in Grade 13-15	27% in Grades 13-15

ORD's older work force requires it to continually upgrade the skills of its staff, but the lack of support for changing or upgrading the skills mix of its personnel can limit research creativity and productivity.

In addition, the declining support for scientific equipment contrains ORD's performance. Figure I[2] illustrates the trend in equipment purchases.

One of EPA's primary goals over the next decade is to improve its institutional capability to conduct risk assessments at both headquarters and regional offices to support environmental decision making. This priority presents major challenges to enhancing the professional skills and development of existing personnel and will influence the type of personnel hired in future years.

Risk assessment "capacity building" will make the EPA's decision making process more "knowledge intensive" not only for the regulatory offices but also for the Office of Research and Development. ORD's traditional role of conducting research and preparing risk assessments will continue, but at least two additional roles are emerging. They include:

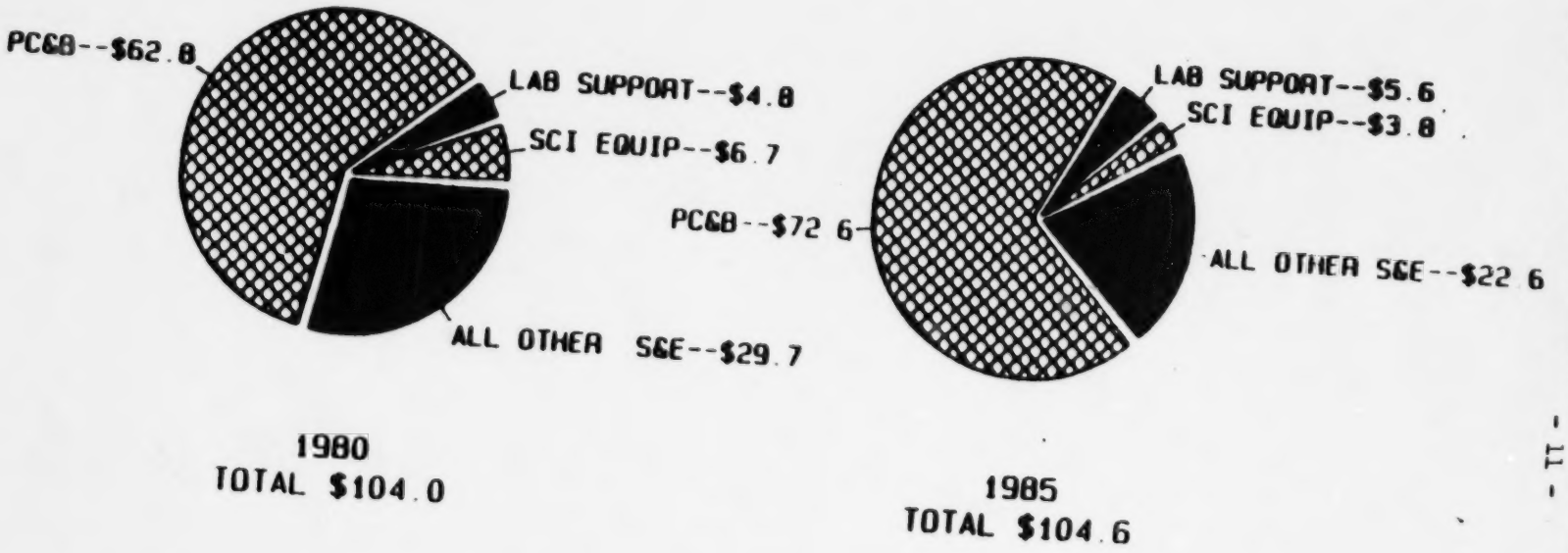
o Developing risk assessment methodologies for specific health (including non-cancer) and ecological effects.

o Providing guidance and technical assistance to regulatory and regional offices and the states to ensure that newly developed scientific methods are consistently used.

An example of these emerging ORD roles can be seen in its water quality based approach research program. For a number of years research scientists, principally at the Duluth Research Laboratory, have developed methodologies for establishing water quality criteria. Over time, these methodologies have become increasingly accepted by the scientific community. While work continues on broadening the use of the methodologies, efforts are also underway to transfer existing techniques to regional permit writers and state and local officials. ORD staff play a prominent role in transfering these techniques and conducting training sessions.

FIGURE 1[2]

ALLOCATION OF SALARIES AND EXPENSE RESOURCES



SCIENTIFIC EQUIPMENT DOLLARS DECLINE BY 43%

TOTAL S&E DOLLARS INCREASE BY .6%

EPA's ability to achieve its goal of building risk-based decision making depends upon its ability to maintain and enhance the technical skills of its personnel through training and other forms of professional development. This is particularly true of the research program where, as previously noted, a workforce older than that found in other EPA offices needs opportunities for matching today's skills with tomorrow's problems.

In order to improve the technical capabilities of its personnel, the Subcommittee recommends that EPA undertake two initiatives:

o Develop a strategy to better define EPA's key scientific staffing needs. Such a strategy should address the magnitude of the current skills mix problem; training and other needs of existing staff; identify which new scientific skills are needed and their relationship to new hiring decisions; develop realistic cost estimates for key risk assessment activities and their relationship to workload models; and recommend specific steps that build risk assessment capacity.

o Analyze the budgetary implications of such a strategy with the goal of making specific recommendations to the Office of Management and Budget and the Congress to provide adequate levels of support.

2. Capability to Define Emerging Problems

EPA frequently addresses public health or environmental issues at the point when they have evolved into problems of serious national or regional concern. Several recent examples document this argument including radon, alternatives to landfilling hazardous wastes and municipal waste combustion.

At present, there are a number of issues that are evolving into areas of greater public concern which, through thoughtful and prompt EPA response, can be effectively managed. Examples include stratospheric ozone modification and climate change, biotechnology, and assessing risks to ecosystems. What is needed is for EPA to develop a better system of "eyes and ears" that can alert it to issues beyond today's immediate regulatory and statutory priorities.

The Subcommittee recommends two mechanisms that can aid EPA in developing an improved capability to define emerging issues. The first is to revive a previous EPA initiative entitled the Environmental Outlook.[3] The purpose of this document was to provide information on environmental trends and future problems. It was particularly useful in discussing the relationship between socio-economic changes and their influence on the environment. Because the Environmental Outlook was not tied to the allocation of resources per se, it was not constrained by the need to justify a particular research budget. The Environmental Outlook 1980 anticipated many of the issues that have emerged as regulatory priorities, including stratospheric modification and municipal waste combustion. EPA should consider re-instituting, on a modest scale, an effort similar to the Environmental Outlook. It has the real potential to assist EPA in anticipating the environmental issues of tomorrow before they reach the problem or crisis stage.

A second mechanism available to EPA is the investigator-initiated exploratory grants program. This program has, for at least two reasons, typically encountered very weak support within EPA and the Office of Management and Budget. The first reason is that it competed for resources with other areas of the research program that had developed closer client relationships with

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the regulatory offices. The second reason is that the relationship of the program to EPA's mission has never been very clear.

For the exploratory grants program to succeed a different rationale is required. The Subcommittee believes the program can assist EPA in developing a capability to define emerging problems. For it to succeed, the program needs to be more closely aligned with EPA's research mission of developing data and methodologies for risk assessment and risk reduction. This will require EPA staff (including laboratory and program office directors) to have a greater voice in articulating the broad problem areas of Agency need. If this occurs, a greater consituency for the program will evolve and should not lessen the ability of extramural scientists to continue their practice of submitting investigator-initiated research proposals, nor compromise their ability to perform innovative research.

IV. Comments on Specific Research Programs

The proposed research budget for FY 88, in general, pursues a direction charted in FY 87 or earlier. Many of the larger changes in funding actually occurred in FY '87. This is especially true in programs devoted to hazardous waste and Superfund research.

In its comments on specific research programs, the Subcommittee evaluates the rationale contained in budgetary support documents that justify funding increases or decreases, and compares this rationale to the conclusions reached by the SAB in the past year in its review of these programs. In addition, the expertise of Subcommittee members has been applied in developing these comments.

The Subcommittee evaluated the following programs:

1. Air

   A. Indoor Air

Approximately $2.5 million is proposed for indoor air research to focus chiefly on source characterization and health effects. This represents a $300,000 decrease above FY '87 levels.

The Subcommittee believes that the additional resources for this program are warranted. Its confidence is reinforced by a series of policy and management changes made in this program during the past several months. On November 5, 1986 the SAB Indoor Air Quality Research Review Panel submitted its review of ORD's plan for determining future needs on indoor air.[4] The Panel's major recommendations included: 1) developing and adopting a clear policy statement that indoor air quality is an important and essential component of the responsibility of the Agency; 2) assigning responsibility for the indoor air quality research program to an individual of appropriate scientific stature with specific experience in this area; 3) the proposed limited field survey should not be carried out as presented since the resources that it would demand are not commensurate with the scientific information and insights that would be obtained; and 4) preparing a relative risk assessment for the more important pollutants (including asbestos, biological contaminants, criteria air pollutants, and toxic chemicals) in order to develop a framework for decision making.

In his response of January 22, 1987 to the Panel Chairman, the Administrator concurred with these recommendations and indicated the steps that were underway to implement them. As a result, the Subcommittee concludes that EPA is increasingly capable of managing the expanded resources to investigate scientifically and programmatically relevant issues.

B. Ambient Air Quality Research

Funding for research to develop and review primary and secondary

National Ambient Air Quality Standards (NAAQS) is proposed at $20.5 million, a reduction of $1.1 million from FY '87. Approximately $2.5 million from this account provides support to the Health Effects Institute (total EPA funding for the Institute is proposed at $3 million).

At least four research objectives could benefit from higher levels of funding in FY '88 compared to previous years. These include:

1) Enhancing the capability for alternative measuring techniques for ambient exposures. This area is one of growing importance because of increased evidence of the shortcomings of fixed station monitoring. There is a need to undertake source characterization of pollutants and understand human activity patterns for exposure assessment. Both issues are essential components in risk assessment.

2) Expanding the support for epidemiological studies. The Harvard Six Cities Study is providing timely and relevant scientific information to EPA in revising the NAAQS for particulate matter. This effort supports the general argument that an expanded epidemiological program can yield cost-effective research results to help resolve policy relevant issues in a time frame compatible with EPA's rulemaking schedule.

3) Improving the capability to extrapolate research results from animals to humans. The field of extrapolation modeling is one that promises to yield a number of scientific insights to link animal studies to human health risk assessment. EPA's extrapolation modeling research efforts, if expanded, can help resolve many of the current scientific uncertainties associated with the use of animal test data.

4) Increasing research on acidic aerosols. The budget proposal does not address this issue, yet it is likely to emerge as one of the more significant public health questions over the next several years, especially in relation to assessing the health risks of acidic deposition.

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C. Forest Effects of Ozone

This issue, at a funding level of $1 million, appears as an initiative in a proposed research budget for the first time and represents a welcome development. In 1985, the SAB evaluated the needs for a research program devoted to forest effects.[5] EPA plans to initiate research in FY '88 to assess the risk from ozone on major coniferous and deciduous tree species, particularly those of commercial value.

D. Global Climate and Stratospheric Modification

These two interrelated issues have rapidly risen on EPA's list of research and regulatory priorities. In FY '87 the Congress provided $1 million for research related to global warming, and the Administration proposes $2.1 million for FY '88; stratospheric ozone was funded at approximately $900,000 in FY '87 and the recommended level for FY '88 remains approximately the same.

The Subcommittee supports this generally upward trend in research funding. It notes that the SAB's Stratospheric Ozone Subcommittee, in its currently ongoing review of EPA's risk assessment document of stratospheric ozone modification, has tentatively concluded that environmental risks to aquatic life and vegetation may be as important as human health risks such as melanoma, non-melanoma, cataracts and potential effects to the immune system.[6]

2. Radiation

Support for radiation research is scheduled to decline from $2.5 million in FY '87 to $1.2 million in FY '88, with the major reduction occurring in radon mitigation research. Funding will continue for off-site testing at the Department of Energy's Nevada Text Site.

The SAB's Radiation Advisory Committee completed a scientific review of EPA's radon mitigation program on January 12, 1987.[7] A major conclusion of

this review was that "the largest potential reduction of public health risk for public funds expended would be achieved by demonstrating a number of low-cost mitigation techniques that have a high probability of success in the majority of residences with radon levels in excess of the recommended guideline. Within the constraints of accommodating the matrix requirements for potential mitigation techniques, high-exposure residences should have priority over lower exposure situations....increased attention [should] be given to pre-and post-mitigation measurements....[there is a] lack of emphasis on mitigation for new construction....and more efforts [are recommended] to include new construction in the text matrix."

At the proposed FY '88 funding levels the Subcommittee concludes that the radon mitigation program cannot achieve its previously stated objectives of developing and publishing acceptable mitigation techniques that will apply to the variety of problems facing American homeowners.

3. Water Quality

The FY '88 budget proposes $24.7 million for water quality research, an increase of $269,000 above the FY '87 appropriation. The water quality program has three major components, including the:

A. Water Quality Based Approach

The methods for developing water quality criteria have undergone a steady evolution and extensive review by scientists. These methods and the resulting criteria have attained wide acceptance by the scientific and regulated communities. EPA and the Congress deserve great credit for providing the scientific leadership and funding over a number of years to achieve the current state-of-the-art.

The SAB's Water Quality Based Approach Research Review Subcommittee evaluated this program in a report dated December 11, 1986.[8] This Subcommittee endorsed the scientific quality of the current program. Among its major recommendations for the future direction of the program were the following:

o From a scientific perspective, spills, and resulting exceedences greatly above criteria concentrations, represent the greatest remaining weakness in the current intensity-duration-frequency regulatory framework.

o The ecoregion methods of defining regional patterns in water chemistry and aquatic biota can be a valuable tool to help states define attainable goals in water quality and aquatic community improvement. EPA should continue to inform states of the ecoregion concept and assess ways in which the concept can be used in state regulatory programs.

o Pollution from nonpoint sources is a significant road block to attaining the national goal of fishable-swimmable waters in many parts of the country. EPA research laboratories should expand their efforts to define and characterize nonpoint source pollution leading to the more effective implementation of control measures.

o A critical need exists for a pro-active technology transfer program to assist state agencies and industry in implementing the water quality based approach for toxics control.

o The Agency needs to coordinate this research program with efforts to develop sediment criteria for toxic chemicals.

The projected 1988 outputs do not identify these major research needs and opportunities, although EPA staff are currently considering whether to include them in a statement of FY '89 needs.

B. Great Lakes

Support for Great Lakes research remains stable. The FY '88 budget proposes $1.94 million compared to an appropriation of $1.95 million in FY '87. This contrasts with the President's suggested reduction of Great Lakes research by 62% in his FY '87 proposal over FY '86 levels. The Congress should ensure that stable research funding continues and seek to appropriate additional resources given the major contribution of the Great Lakes for water supply, recreation and other uses.

C. Sludge

Research funding for innovative/alternative wastewater technologies, sludge management alternatives and toxicity reduction methods is recommended at $8.8 million, a reduction of $234,000 from FY '87. Several of the major areas of scientific uncertainty identified by the SAB[9] in its recent review of sludge management disposal options are listed as planned research program outputs for FY '88. These include: evaluation of the toxicity of chronic exposure to chemicals found in sludge; development of design and performance information for landfills that receive sludge containing toxic organic substances; preparation of five environmental indices/hazard profiles for chemicals in sludge; and development of criteria for risk assessment of pathogens in sludge. These and other objectives address high priority research needs. They should ultimately assist the EPA in generating more realistic risk estimates of various sludge disposal options.

4. Drinking Water

The FY '88 budget proposes a reduction in drinking water research by $72,000 for a total program commitment of $23.9 million. Many scientifically relevant issues are incorporated in the Agency's projected FY '88 outputs which reflect additional needs and responsibilities resulting from passage

of the 1986 Amendments to the Safe Drinking Water Act. These issues include: target organ toxicity of drinking water disinfectants and disinfectant by-products, and controlling disinfection by-products; analytical method validation studies for organic contaminants newly regulated under the Act; developing a methodology to identify viruses and bacteria for exposure assessment; and evaluating processes for removing volatile organic compounds, pesticides and radionuclides.

The Subcommittee is concerned, however, that an imbalance exists between the Agency's increased regulatory responsibilities and lack of a commensurate increase in research funds to support these responsibilities. The Subcommittee also questions whether these and other research priorities will attract a critical mass of funding and staff to meet program commitments.

5. Pesticides/Toxic Substances

In general, research in pesticides and toxic substances declines by $1.4 million from FY '87 for a total of $42.2 million. The Science Advisory Board has reviewed several pesticide and toxic substances' research areas in the past one and one-half years. These include:

A. Biotechnology

Planned FY '88 outputs for this program include a report on the movement and survival and biological control agents in two natural systems; and health research to provide methods for detecting and monitoring such agents in mammalian cells as a basis for developing test protocols. The proposed budgetary support for these and other activities is $7.3 million, an increase of $350,000.

In its February 7, 1986 report on EPA's biotechnology research program, the SAB's Study Group on Biotechnology recommended that EPA develop

a program broader and larger than that envisioned by EPA decision makers.[10] It identified critical priorities in three areas in which EPA lacked a research capability: 1) dispersal of genetically engineered organisms; 2) remedial action in the event of a release of such organisms; and 3) environmental effects of a release, either beneficial or detrimental.

EPA has made modest beginnings in initiating research for some of these critical needs, but the Science Advisory Board continues to believe that EPA's biotechnology research program, as envisioned for FY '88, does not effectively address these needs to a sufficient degree.

B. Ecological Risk Assessment

Ecological risk assessment is an EPA research program of very recent origin. The SAB's Ecological Risk Assessment Research Review Subcommittee completed its evaluation of this program on January 16, 1987, and was favorably impressed with the degree of progress made since its inception in 1985.[11] Its major conclusion was that the program is comprehensive and scientifically ambitious. It sets forth a research direction for the long-term (perhaps twenty years). In the short-term (five years), it is not achievable as planned, particularly because some of the key elements (density-dependent population, community and ecosystem mechanistic models) are based on an incomplete understanding of the fundamental mechanisms. However, the research staff have made a promising start in identifying some of the major issues this program should address. This, combined with some fine-tuning in the research plan, can produce both an innovative research program and one that can deliver shorter-term research products.

There is an underlying implicit emphasis (which is at times explicit) on computer programming, computational algorithms, and decision support

systems. It is imperative that such decision making tools have a sound scientific foundation. Since resources for this program are limited, EPA should concentrate its research efforts on the development and acquisition of the scientific data for these decision support systems.

The proposed FY '88 budget for this program is $2.6 million, a reduction of approximately $500,000 from the current fiscal year. The Subcommittee believes that this program, if maintained over a number of years, can achieve a number of useful research results. It should receive increased and not decreased support.

C. Structure Activity Relationships

Structure Activity Relationships (SAR) is a widely used tool in EPA's toxic substances regulatory program, particularly the premanufacturing program for new chemicals. Through analyses of existing chemical structures scientists draw assumptions about the behavior of new chemicals with similar or different structures. Many scientific uncertainties persist in the use of SAR which EPA's research program is designed to address.

For FY '88, the Administration proposes to increase funding for this program by $600,000 to $2.3 million. Among the proposed activities for FY '88 include: analyses of structurally similar compounds; developing a computer based system to correlate chemical structure with biological activity; and developing predictive methods.

The Subcommittee believes that these expanded resources can support an important Agency need. It urges that Congress expand the research program to enable further evaluation of non-cancer health endpoints.

6. Hazardous Wastes/Superfund

EPA's technical information needs to support its hazardous waste

management programs have greatly increased in the past several years. The reauthorization of Superfund enables the Agency to develop a research program that can begin to address these expanded needs. The technical challenges facing this particular research program are as large, or larger, than those confronted for any other environmental problem.

EPA and the Congress anticipated the greater needs for scientific support for hazardous waste research in FY '87. ORD received approximately $40 million in augmented resources for Superfund/LUST for this year, and the FY '88 proposal recommends a total allocation of nearly $60 million for this account. Research support for hazardous wastes (excluding Superfund/LUST) declines by $5.3 million to $45.2 million in FY '88. $2.5 million of this deletion was withdrawn from a Congressional earmark for the Tufts University Center for Environmental Management. The Subcommittee strongly and unanimously urges that future decisions on research centers result from a competitive peer review process. The total research dollars available for the combined hazardous waste/Superfund/LUST programs amount to $105.0 million, an increase of 15% over the FY '87 level of $90.2 million.

The Science Advisory Board has examined three specific areas within this program. They include:

A. Superfund Innovative Technologies Evaluation (SITE)

The goal of the SITE program is to enhance the development, demonstration and use of new or innovative technologies to provide ultimate remedies for the prevention or mitigation of releases of hazardous substances from Superfund sites. The program will function through a demonstration of selected technologies at specific sites. It is expected that the private sector will provide resources for the operational costs of technology demonstrations, while EPA will pay for sampling and analyses costs.

The SAB's Environmental Engineering Committee evaluated the SITE Strategy and Program Plan in a report to the Administrator on June 24, 1986.[12] It concluded that the program had made a clear exposition of its goals and demonstrated an understanding of the impediments to the development and use of alternative technologies. Liability and permitting are two major barriers that need to be resolved before the program can be fully implemented. Approximately $18.5 million is proposed for SITE program funding in FY '88, an increase of about $10 million from the current year. The Subcommittee believes that, contingent upon resolving the liability and permitting problems, the initial prospect for the success of this program is good.

B. Alternative Hazardous Waste Technologies Program

The objective of this research program is to develop data to implement those sections of the Hazardous and Solid Waste Act Amendments of 1984 that require the banning of high hazard wastes from land disposal. For FY '88, the proposed budget is $4.6 million, a $100,000 decrease from FY '87.

The current program has five major components: technology assessment of existing processes for the treatment of wastes; solidification/stabilization (s/s), which concentrates on the characterization of wastes and binders, the performance of s/s technologies and a field verification effort; emerging technologies, which emphasizes filling gaps in waste technology needs and continuing the development of specific technologies; waste minimization, directed primarily at documenting current industry practices; and disseminating information about the program.

The SAB Environmental Engineering Committee submitted its review of this program on September 18, 1986.[13] Its major comments for improving the program included:

o It is primarily oriented towards RCRA-related research not

all of which is applicable to Superfund (and particularly not to problems Superfund will face as a result of the RCRA land banning decisions). The Superfund portion of the program should be designed to address these gaps.

o The waste minimization component should be significantly strengthened, especially to include establishing a formal network between industry, academia, and government to share successful strategies, practices, data, and programs. More emphasis should be placed on the reduction or elimination (as a result of process changes or product formulations) of hazardous wastes.

o ORD should review the choices for evaluating existing technologies/ processes for the treatment of wastes which are to be banned from land disposal under the 1984 RCRA amendments to be sure that potentially significant processes have not been overlooked (such as biological treatment of aqueous organic liquids, steam stripping of wastewaters, and treatment of residuals from solvent recovery).

o The in-house program should be expanded to provide valuable hands-on experience to the staff, and to aid the staff in selecting technologies and managing extramural projects.

The Subcommittee concludes that the proposed FY '88 budget will not meet all the above listed needs.

C. Municipal Waste Combustion

A number of intersecting events have combined to alter the nation's awareness, and the public policy framework, regarding municipal waste management. These include: growing amounts of municipal waste to be collected and disposed; shrinking landfill capacity, particularly in large urban areas; limitations

in the current potential for recycling waste and reducing the volume of wastes generated; difficulties in gaining public acceptance to site new landfills or other technologies; escalating costs in transportation and storage of municipal wastes; concerns over the public health and environmental impacts of storing municipal wastes in landfills, including ground water contamination; potential for environmental controls on landfills that will increase their operating costs and legal liability; public health and environmental concerns over alternative waste management-strategies, including incineration and ocean dumping; and Congressional action through the Hazardous and Solid Waste Act Amendments of 1984 that favor more permanent methods of disposal (i.e. incineration) over the storage of wastes.

During the early 1980's EPA's combustion research program suffered drastic funding reductions. As a result, the Agency is currently playing catch-up to rebuild its research program and to enhance the technical skills of existing staff. This occurs at a time of significant public controversy concerning the incineration of municipal wastes, and of hazardous wastes at sea and on land. One of the major reasons that EPA experiences such great difficulty in gaining public acceptance for its decisions on incineration technologies stems from its inability to provide scientific answers to a host of questions as to whether waste incineration poses unacceptable risks to public health and the environment.

The FY '88 budget proposal for incineration--$2.4 million for both municipal and hazardous wastes--will not appreciably improve the Agency's ability to resolve many of the technical questions, or defend its risk management choices.

7. Energy/Acid Rain

The overwhelming majority of the resources in this program will be earmarked for acidic deposition research. The acidic deposition budget contains approximately $55.3 million for FY '88, a modest decrease from $55.4 million in the current year. Given EPA's other pressing research priorities, the Subcommittee concurs with the recommendation not to increase support for this effort. For the same reason it supports the decision not to fund cold climate or synfuels research.

8. Interdisciplinary Research

The interdisciplinary research program includes a diverse set of activities such as developing guidelines to promote more consistency in risk assessment, managing the Agency-wide quality assurance program, the visiting scientist program and exploratory centers and grants.

The latter two are the best known components of the interdisciplinary program. Beginning in FY '85, EPA initiated a series of changes in its management of the centers and also marginally increased their funding levels to approximately $540,000 per center. In general, the centers and EPA staff have also evolved a closer working relationship which is reflected in the recommendation that the FY '88 funding level of $4.5 million for the program remains constant from the current year.

The Subcommittee reiterates the recommendation contained in the SAB's 1985 review of the centers program that EPA should fund each center at a minimum level of $750,000-$1,000,000 to enable them to acquire a critical mass of core support resources and become more productive than their current capability. It notes that SARA enables EPA to create additional centers but that no funds were requested.

The exploratory grants program continues to suffer from the lack of a constituency within EPA or the Administration. This is further reflected in the reduction of support for grants in FY '88 to $10.7 million from the FY '87 level of $14.0 million. The Subcommittee believes that the program should be modified to more clearly support EPA's mission of developing data and methodologies for risk assessment and risk reduction, while still perserving its investigator-initiated character. EPA sould involve its laboratory and program office staff in identifying specific long-range problem areas that individual investigators could respond to within the current competitive framework, subject to review by peer panels. This would expand EPA's institutional stake in the program, assist its becoming more responsive to ORD and EPA needs, while still preserving the freedom of individual researchers to submit scientifically creative proposals. In summary, the Subcommittee believes that alternatives are needed to the current operation of the grants problem because the continuation of the status quo will produce increasing frustration for both EPA and the scientific community. At best, the continuation of current practice will result in maintaining a program that, at present, is too small to have a major impact in advancing scientific knowledge for EPA decision makers.

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APPENDIX I

Resources Are Distributed by Medium as Follows:

	1988 Research Budget	
Research Program	$ (M)	Change from 1987
Air	65.5	+2.4
Water	24.7	+0.3
Drinking Water	23.9	-0.1
Hazardous Waste	45.2	-5.3
Pesticides	13.2	+0.7
Radiation	1.4	-1.3
Interdisciplinary	22.9	-5.0
Toxic Substances	29.0	-2.1
Energy/Acid Rain	58.9	-0.7
Superfund/LUST	59.1	+19.3
Management/Support	9.8	+0.1
	$353.5	+8.3

Source: Office of the Comptroller, U. S. Environmental Protection Agency, March, 1987.